09/856738

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TRANSMITTAL FORM

(to be used for all correspondence after initial filing)

Application Number	Patent#: 7,010,027
Filing Date	Issued: March 7, 2006
First Named Inventor	Denis Julien Gilles Mestdagh
Art Unit	2133
Examiner Name	J. D. Torres
Attorney Docket Number	S1022.80315US00
Total Number of Pages in This Submission	

ENCLOSURES (*Check all that apply*)

- [x] Fee Transmittal Form
  - [x] Fee Attached
- [ ] Amendment/Reply
  - [ ] After Final
  - [ ] Affidavits/declaration(s)
- [x] Request for Certificate of Correction
- [x] Certificate of Correction
- [ ] Information Disclosure Statement
- [x] ~~Title Page and~~ Cols. 2, 4 and 7 of U.S. Patent No. 7,010,027
- [ ] Reply to Missing Parts/ Incomplete Application
  - [ ] Reply to Missing Parts under 37 CFR 1.52 or 1.53
- [ ] Drawing(s)
- [ ] Licensing-related Papers
- [ ] Petition
- [ ] Petition to Convert to a Provisional Application
- [ ] Power of Attorney, Revocation Change of Correspondence Address
- [ ] Terminal Disclaimer
- [ ] Request for Refund
- [ ] CD, Number of CD(s) ______
  - [ ] Landscape Table on CD
- [ ] After Allowance Communication to TC
- [ ] Appeal Communication to Board of Appeals and Interferences
- [ ] Appeal Communication to TC (**Appeal Notice, Brief, Reply Brief**)
- [ ] Proprietary Information
- [ ] Status Letter
- [x] Other Enclosure(s) (please Identify below):

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Remarks

Certificate
JAN 18 2007
of Correction

SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT

Firm Name	WOLF, GREENFIELD & SACKS, P.C.		
Signature			
Printed name	James H. Morris		
Date	January 12, 2007	Reg. No.	34,681

Certificate of Mailing Under 37 CFR 1.8(a)

I hereby certify that this paper (along with any paper referred to as being attached or enclosed) is being deposited with the U.S. Postal Service on the date shown below with sufficient postage as First Class Mail, in an envelope addressed to: Commissioner for Patents, P.O. Box 1450, Alexandria, VA 22313-1450.

Dated: January 12, 2007 Signature: ______ (Gail Driscoll)

JAN 19 2007

1132938.1

PTO/SB/17 (07-06)
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Effective on 12/08/2004.
Fees pursuant to the Consolidated Appropriations Act, 2005 (H.R. 4818).

FEE TRANSMITTAL
For FY 2005

☐ Applicant claims small entity status. See 37 CFR 1.27

TOTAL AMOUNT OF PAYMENT ($) 100.00

Complete if Known	
Application Number	Patent#: 7,010,027
Filing Date	Issued: March 7, 2006
First Named Inventor	Denis Julien Gilles Mestdagh
Examiner Name	J. D. Torres
Art Unit	2133
Attorney Docket No.	S1022.80315US00

METHOD OF PAYMENT (check all that apply)

☒ Check ☐ Credit Card ☐ Money Order ☐ None ☐ Other (please identify): ______

☐ Deposit Account Deposit Account Number: 23/2825 Deposit Account Name: Wolf, Greenfield & Sacks, P.C.

For the above-identified deposit account, the Director is hereby authorized to: (check all that apply)

☐ Charge fee(s) indicated below ☐ Charge fee(s) indicated below, **except for the filing fee**

☐ Charge any additional fee(s) or underpayment of fee(s) under 37 CFR 1.16 and 1.17 ☒ Credit any overpayments

FEE CALCULATION

1. BASIC FILING, SEARCH, AND EXAMINATION FEES

	FILING FEES		SEARCH FEES		EXAMINATION FEES		
Application Type	**Fee ($)**	**Small Entity Fee ($)**	**Fee ($)**	**Small Entity Fee ($)**	**Fee ($)**	**Small Entity Fee ($)**	**Fees Paid ($)**
Utility	300	150	500	250	200	100	
Design	200	100	100	50	130	65	
Plant	200	100	300	150	160	80	
Reissue	300	150	500	250	600	300	
Provisional	200	100	0	0	0	0	

2. EXCESS CLAIM FEES

Fee Description	**Fee ($)**	**Small Entity Fee ($)**
Each claim over 20 (including Reissues)	50	25
Each independent claim over 3 (including Reissues)	200	100
Multiple dependent claims	360	180

Total Claims ____ - ____ = **Extra Claims** ____ x **Fee ($)** ____ = **Fee Paid ($)** ____

HP = highest number of total claims paid for, if greater than 20.

Indep. Claims ____ - ____ = **Extra Claims** ____ x **Fee ($)** ____ = **Fee Paid ($)** ____

HP = highest number of independent claims paid for, if greater than 3.

Multiple Dependent Claims
Fee ($) ____ **Fee Paid ($)** ____

3. APPLICATION SIZE FEE

If the specification and drawings exceed 100 sheets of paper (excluding electronically filed sequence or computer listings under 37 CFR 1.52(e)), the application size fee due is $250 ($125 for small entity) for each additional 50 sheets or fraction thereof. See 35 U.S.C. 41(a)(1)(G) and 37 CFR 1.16(s).

Total Sheets ____ - 100 = **Extra Sheets** ____ /50 **Number of each additional 50 or fraction thereof** ____ (round up to a whole number) x **Fee ($)** ____ = **Fee Paid ($)** ____

4. OTHER FEE(S) **Fees Paid ($)**

Non-English Specification, $130 fee (no small entity discount)

Other (e.g., late filing surcharge): 1811 Certificate of correction 100.00

SUBMITTED BY					
Signature	James	Registration No. (Attorney/Agent)	34,681	Telephone	(617) 646-8000
Name (Print/Type)	James H. Morris			Date	January 12, 2007

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Dated: January 12, 2007 Signature: Gail Driscoll (Gail Driscoll)

Docket No.: S1022.80315US00
(PATENT)

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant:	Denis Julien Gilles Mestdagh et al.	
Serial No.:	09/856,738	Patent No. 7,010,027
Filed:	October 1, 2001	Issued March 7, 2006
For:	MULTISTANDARD DMT DSL TRANSMISSION SYSTEM	
Examiner:	J. D. Torres	
Art Unit:	2133	Confirmation No. 3232

Certificate of Mailing Under 37 CFR 1.8(a)
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Dated: January 12, 2007

Gail Driscoll
Gail Driscoll

REQUEST FOR CERTIFICATE OF CORRECTION
PURSUANT TO 37 CFR 1.323

Attention: Certificate of Correction Branch
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

Dear Sir:

Upon reviewing the above-identified patent, Patentee noted typographical errors which should be corrected.

In the Specification:

In column 2, lines 46 - 47 should read:

-- high transmission rate, the system uses N=4096/p tones spaced by 4.3125q kHz wherein p and q are powers of 2 (p=1, 2, 4, 8, . . . ; q=1, 2, 4, 8, . . .).--

In column 4, line 29 should read:

--tion by the analog front-end. --

In the Claims:

Claim 1, line 2 should read:

--QAM modulation on N=4096/p tones spaced 4.3125q kHz--

Upon reviewing the issued patent, Patentee notice a typographical error in claim 1 and the specification at column 4, line 29. This request for a certificate of Correction corrects the typographical errors and also corrects the Summary of the Invention and the Abstract to ensure consistency with the claims. Our check in the amount of $100.00 covering the fee set forth in 37 CFR 1.20(a) is enclosed.

The errors now sought to be corrected are inadvertent typographical errors the correction of which does not involve new matter or require reexamination.

Transmitted herewith is a proposed Certificate of Correction effecting such amendment. Patentee respectfully solicits the granting of the requested Certificate of Correction.

The Director is hereby authorized to charge any deficiency in the fees filed, asserted to be filed or which should have been filed herewith (or with any paper hereafter filed in this application by this firm) to our Deposit Account No. 23/2825, under Docket No. S1022.80315US00. A duplicate copy of this paper is enclosed.

Dated: January 12, 2007

Respectfully submitted,

By: James

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JAN 1 9 2007

MULTISTANDARD DISCRETE MULTI-TONE (DMT) DIGITAL SUBSCRIBER LINE (DSL) SYSTEM

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to discrete multitone (DMT) based digital subscriber line (DSL) transmission systems which allow high speed communication on twisted pair telephone lines. The invention relates more specifically to a VDSL (Very high speed DSL) system which can be used with several existing or forthcoming standards.

2. Discussion of the Related Art

FIG. 1 shows the spectrum of a signal transmitted according to the ADSL and ADSL-Lite (asymmetric DSL) standards. The ADSL standard uses quadrature amplitude modulation (QAM) on each of 256 tones, the tones being equally spaced by 4.3125 KHz. Thus, as shown, the last tone has a frequency of 1.104 MHz. The ADSL-Lite standard only uses the first 128 tones.

As shown, a gap is left at the beginning of the spectrum for "plain old telephone services" (POTS).

According to the ADSL standards, most of the tones are used for reception, the few remaining tones being used for transmission, hence the term "asymmetric DSL".

Current VDSL standardization proposals contemplate the use of frequencies up to 11.04 MHz.

FIG. 2 shows the spectrum of a signal transmitted by a conventional VDSL time domain duplexing (TDD) system such as described in "VDSL Alliance SDMT VDSL Draft Standard Proposal", ETSI STC/TM6, 973T13R0, Lannion, France, September 29–Oct. 3, 1997. This system uses 256 or 512 tones spaced, respectively, by 43 or 21.5 KHz. The last tone has a frequency of 11.04 MHz. All the tones are used for a same transmission direction at one time, the transmission direction being switched every other transmitted symbol.

FIG. 3 shows the spectrum a signal transmitted by a conventional VDSL "Zipper" system as disclosed in patent application WO 97/06619. It uses 2048 tones spaced by 5.375 KHz, the last tone also having a frequency of 11.04 MHz. In this system, the tones used for transmission and for reception are chosen dynamically in order to cancel near-end crosstalk and near-end echoes.

FIG. 4 very schematically shows a DSL transmission system at one end of a telephone line **10**. An inverse fast Fourier transform (IFFT) circuit **12** receives N complex frequency domain coefficients, where N is the number of tones used by the system, i.e. 128 or 256 for the ADSL standards, 256 or 512 for the VDSL TDD system, and 2048 for the VDSL Zipper system. The IFFT circuit **12** generates, for each set of N coefficients, a time domain symbol. A symbol is thus the sum of N sinusoidal subcarriers of different frequencies corresponding respectively to the tones. The amplitude and phase of each subcarrier is determined by the corresponding frequency domain coefficient received by the IFFT circuit. The symbols are processed by a digital-to-analog converter **14** and a low-pass filter **16** and then transferred onto telephone line **10** through a hybrid line interface **18**.

A cyclic prefix and a cyclic suffix are added to the symbol output by IFFT circuit **12** at **19**. The cyclic prefixes are intended to eliminate intersymbol interference in the far-end receiver by providing a guard period during which the propagation transients of the line may decay. The cyclic

suffix is intended to cancel the effects of the sampling of discontinuities in near-end echoes.

Line interface **18** also receives incoming symbols from line **10**. These incoming symbols are provided to a fast Fourier transform (FFT) circuit **20** through a low-pass filter **22**, an analog-to-digital converter **24** and, if necessary, through a time domain equalizer **26**.

The above mentioned cyclic prefix, in order to accomplish its role, has a minimum length independent of the symbol length. In DSL systems using a relatively low number of tones, such as ADSL and VDSL TDD, the transmitted symbols are short, whereby the minimum length of the cyclic prefix is so long that it causes a substantial efficiency loss in the data transmission. In this case, the cyclic prefix is chosen shorter than necessary and it is the role of the time domain equalizer **26** to complement the short cyclic prefixes in the elimination of the intersymbol interference.

In DSL systems using a large number of tones, such as in the VDSL Zipper system, the generated symbols are so long that the cyclic prefixes can be chosen at the necessary length without substantially affecting the efficiency of the transmission. In such systems, the time domain equalizer **26** is omitted.

Moreover, in a VDSL TDD system, since the IFFT circuit and FFT circuit are never used at the same time, it is a single circuit which performs both functions.

The IFFT and FFT circuits operate at least at twice the frequency of the last tone used by the system, i.e. 1.104 MHz for ADSL-Lite, 2.208 MHz for ADSL, and 22.08 MHz for the known VDSL systems.

It is clear that the ADSL standards and forthcoming VDSL standards differ in many ways (the number of used tones, the spacing between the tones, the operation frequency of the IFFT and FFT circuits . . .), which is likely to increase the number of types of modems capable of exploiting these standards.

SUMMARY OF THE INVENTION

An object of the invention is to provide a transmission system which allows a single modem to exploit many DSL standards with a low complexity.

To achieve this and other objects, the invention provides a digital subscriber line transmission system using QAM modulation on several equally spaced discrete tones. At a high transmission rate, the system uses N=2048/p or 4096/p tones spaced by 4.3125p KHz, where p is a power of 2.

According to an embodiment of the invention, for transmitting at a low transmission rate according to an ADSL standard, only the first n=128 or 256 tones are used with p=1.

According to an embodiment of the invention, the system comprises, on the transmitter side, an inverse fast Fourier transform circuit having N frequency domain value inputs corresponding to said tones, among which only the first receive values corresponding to the n used tones, the remaining inputs being zeroed, a decimator providing one sample for every r samples output by the IFFT circuit, with r=N/n, and a digital-to-analog converter coupled between the decimator and a subscriber line.

According to an embodiment of the invention, the system comprises, on the receiver side, an analog-to-digital converter sampling the signal on the subscriber line at a frequency F/r, where F is the operating frequency of the IFFT circuit; an interpolator generating samples at frequency F from the samples provided by the analog-to-digital converter; and a fast Fourier transform circuit operating at

Controller **60** also sets the sampling frequency of analog-to-digital converter **24** at the operating frequency of the IFFT and FFT circuits. Moreover, controller **60** bypasses the time domain equalizer **26** and the radio frequency interference canceller **26**, as shown by switches, when the number of tones used by the system is equal to 2048 or 4096.

Elements of the architecture of FIG. **8** which are not further described are conventional and can be found in modems for existing standards, such as ADSL and ADSL-Lite (disclosed in Standard T1.413).

Having thus described at least one illustrative embodiment of the invention, various alterations, modifications, and improvements will readily occur to those skilled in the art. Such alterations, modifications, and improvements are intended to be within the spirit and scope of the invention. Accordingly, the foregoing description is by way of example only and is not intended as limiting. The invention is limited only as defined in the following claims and the equivalents thereto.

What is claimed is:

1. A digital subscriber line transmission system using QAM modulation on N=4096/p tones spaced by 4.3125 kHz wherein p and q are powers of 2 (p=1, 2, 4, 8, . . . ; q=1, 2, 4, 8, . . .), including at least two operating modes:

a VDSL standard operating mode where all N tones are used to convey significant values; and

an ADSL standard operating mode where only the first n among the N tones are used to convey significant values;

comprising, on the transmitter side:

an inverse fast Fourier transform circuit having N frequency domain value inputs corresponding to said tones, among which only the first receive values corresponding to the n used tones, the remaining inputs being zeroed,

a decimator providing one sample for every r samples output by the inverse fast Fourier transform circuit, with r=N/n,

a digital-to-analog converter coupled between the decimator and a subscriber line;

comprising, on the receiver side:

an analog-to-digital converter sampling the signal on the subscriber line at a frequency F/r, where F is the operating frequency of the inverse fast Fourier transform circuit;

an interpolator generating samples at frequency F from the samples provided by the analog-to-digital converter; and

a fast Fourier transform circuit operating at frequency F and receiving the samples from the interpolator through a time domain equalizer;

wherein, when all N tones are used, the time domain equalizer is bypassed.

2. The system of claim **1** comprising, at a transmitter side, an inverse fast Fourier transform circuit having:

a number of frequency domain inputs selectable at least among values N and n; and

an operating frequency selectable at least among two values F and fn proportional, respectively, to the frequency of the last of the N tones and the last of the n tones.

3. The system of claim **2**, comprising, at a receiver side, a fast Fourier transform circuit having:

a number of frequency domain outputs selectable at least among values N and n; and

an operating frequency selectable at least among values F and fn.

4. The system of claim **3**, wherein each of the inverse fast Fourier transform and fast Fourier transform circuits includes five radix-4 stages and a last stage having a radix selectable among 2 and 4, all connected to operate in pipeline mode, the desired number of frequency domain inputs or outputs of the circuit being selectable by bypassing a number of the five radix-4 stages and by selecting the radix of the last stage.

5. The system of claim **4**, wherein the desired number of frequency domain inputs or outputs of the circuit is the product of the radices of all stages which are not bypassed.

6. The system of claim **4**:

wherein each stage receives and provides complex coefficients at a digital data transmission rate;

wherein each complex coefficient has a real part and an imaginary part;

wherein the real part of each complex coefficient and the imaginary part of each complex coefficient are processed in two distinct cycles; and

wherein the operating frequency of the system is twice the digital data transmission rate.

7. The system of claim **4**, wherein an ADSL-Lite standard operating mode is implemented by bypassing two of the five radix-4 stages and selecting the last stage to be radix-2.

8. The system of claim **7**, wherein the operating frequency is 1.104 MHz.

9. The system of claim **4**, wherein an ADSL standard operating mode is implemented by bypassing two of the five radix-4 stages and selecting the last stage to be radix-4.

10. The system of claim **9**, wherein the operating frequency is 2.208 MHz.

11. The system of claim **4**, wherein a VDSL standard operating mode, using N=2048 tones, is implemented by bypassing none of the five radix-4 stages and selecting the last stage to be radix-2.

12. The system of claim **11**, wherein the operating frequency is 17.664 MHz.

13. The system of claim **4**, wherein a VDSL standard operating mode, using N=4096 tones, is implemented by bypassing none of the five radix-4 stages and selecting the last stage to be radix-4.

14. The system of claim **13**, wherein the operating frequency is 35.328 MHz.

15. The system of claim **4**, wherein a VDSL standard operating mode being used for a VDSL-TDD transmission using 512 tones is implemented by bypassing one of the radix-4 stages and selecting the last stage to be radix-2.

16. The system of claim **4**, wherein a VDSL standard operating mode being used for a VDSL-TDD transmission using 256 tones is implemented by bypassing two of the radix-4 stages and selecting the last stage to be radix-4.

17. The system of claim **4**, wherein a VDSL standard operating mode may be used for a VDSL-TDD transmission, the VDSL-TDD transmission having a maximum frequency of 17.664 MHz.

18. The system of claim **4**, wherein a VDSL standard operating mode may be used for a VDSL-TDD transmission, the VDSL-TDD transmission having a maximum frequency of 35.328 MHz.

19. The system of claim **1**, wherein a receiving modem can identify the standard operating mode before establishing communication with a transmitting modem.

frequency F and receiving the samples from the interpolator through a time domain equalizer. When all N tones are used, the time domain equalizer is bypassed.

According to an embodiment of the invention, the system is applicable to a standard using n first tones among the N tones, where n is a power of 2. It comprises, at a transmitter side, an IFFT circuit having a number of frequency domain inputs selectable at least among values N and n; and an operating frequency selectable at least among two values F and fn proportional, respectively, to the frequency of the last of the N tones at the high transmission rate, and to the last of the n tones.

According to an embodiment of the invention, the system comprises, at a receiver side, an FFT circuit having a number of frequency domain outputs selectable at least among values N and n; and an operating frequency selectable at least among values F and fn.

According to an embodiment of the invention, each of the IFFT and FFT circuits includes five radix-4 stages and a last radix-2 or radix-4 stage connected to operate in pipeline mode, the desired number of frequency domain inputs or outputs of the circuit being selected by bypassing an appropriate number of stages and by selecting the radix of the last stage.

The foregoing and other objects, features, aspects and advantages of the invention will become apparent from the following detailed description of embodiments, given by way of illustration and not of limitation with reference to the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1**, previously described, shows a spectrum of signals transmitted according to the ADSL and ADSL-Lite standards;

FIG. **2**, previously described, shows a spectrum of signals transmitted in a conventional VDSL TDD system;

FIG. **3**, previously described, shows a spectrum of signals transmitted in a conventional VDSL "Zipper" system;

FIG. **4** partially and schematically shows a DSL transmission system;

FIG. **5** shows a spectrum of signals transmitted in an embodiment of a VDSL system according to the invention;

FIG. **6** partially and schematically shows an embodiment of a VDSL system according to the invention adaptable to the ADSL and ADSL-Lite standards;

FIG. **7** schematically shows an embodiment of an IFFT circuit used in a VDSL system according to the invention; and

FIG. **8** schematically shows an architecture of a universal DSL modem according to the invention, incorporating IFFT and FFT circuits according to FIG. **7**.

DETAILED DESCRIPTION

As illustrated by the spectrum of FIG. **5**, an aspect of the invention is to extend the spectrum of an ADSL-Lite transmission in order to approach the maximum frequency used in conventional VDSL systems, i.e. 11.04 MHz. The number of tones should be a power of 2 to be compatible with IFFT and FFT circuits of conventional architecture. In the embodiment of FIG. **5**, the invention uses either 2048 or 4096 tones spaced by 4.3125 KHz. By using 2048 tones, the last tone has a frequency of 8.832 MHz, whereby the transmission rate is slightly reduced with respect to a system which uses tones up to the design limit of 11.04 MHz. In fact, this does not significantly reduce the transmission rate, because, in most cases, the last tones near 11.04 MHz can only convey very little information or no information at all due to a large attenuation.

However, in case the transmission conditions are excellent, the invention allows the use of 4096 tones spaced by 4.3125 KHz, whereby the last tone has a frequency of 17.664 MHz.

An aspect of the invention is to note that such a system, using 2048 tones or 4096 tones, is immediately usable with any standard using fewer tones at the same spacing, such as 128 or 256 (ADSL-Lite, ADSL).

To transmit data according to the ADSL or ADSL-Lite standards with the above solution, it is sufficient to just use the first 128 or 256 tones by providing corresponding coefficients to the first frequency domain inputs of the IFFT circuit, and by zeroing the remaining inputs. In reception mode, the FFT circuit will extract and provide to its first 128 or 256 outputs the desired coefficients, the remaining coefficients being zero.

The only modification needed to the transmission system is to provide zero-padding and depadding circuitry for adapting the low rate of the effective digital data transmission to the fixed high operation speed of the IFFT and FFT circuits.

A drawback of such a system is however that it operates at the highest frequency, adapted to the highest transmission rate, whereas the effective data transmission rate may be much lower. This causes unnecessary extra power consumption vy the analog front-end.

FIG. **6** schematically shows an embodiment of a transmission system operating as described above and additionally provided with circuitry for reducing the power consumption. As an example, the system is intended to operate with 2048 tones and is used with the ADSL standard, which will only use 256 tones. As shown, only the first 256 inputs of IFFT circuit **12** and the 256 first outputs of FFT circuit **20** are used.

The IFFT and FFT circuits operate at 17.664 MHz, i.e. twice the frequency of the last of the 2048 tones. The IFFT circuit **12** thus generates samples at 17.664 MHz. These samples are provided to a decimator **30** which provides only every 8th sample to digital-to-analog converter **14**. Digital-to-analog converter **14** then operates 8 times slower, i.e. at 2.208 MHz. Of course, the cut-off frequency of the low-pass filters **16** and **22** is adapted to the frequency of the digital-to-analog converter **14**.

The analog-to-digital converter **24** is clocked to sample the received signal 8 times slower, i.e. at 2.208 MHz, and the samples are provided to an interpolator **32** which generates the missing samples to provide to FFT circuit **20** at 17.664 MHz.

With the above example, the power consumed by converters **14** and **24** is substantially reduced. This power consumption will be further reduced if the ADSL-Lite standard is used with the system.

When the system is used at its highest transmission rate, the decimator **30** and the interpolator **32** are bypassed as shown by switches, and the analog-to-digital converter **24** is clocked at the same speed as the IFFT and FFT circuits, i.e. 17.664 MHz in the example.

A purpose of a second embodiment of the invention is to further reduce the power consumption when the system is used at lower transmission rates.

In order to reduce the power consumption, it would be useful to also adapt the operating frequency of the IFFT and FFT circuits to the transmission rate effectively used, like the clock frequency of analog-to-digital converter **24** in FIG.

PTO/SB/44 (04-05)
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(Also Form PTO-1050)

UNITED STATES PATENT AND TRADEMARK OFFICE
CERTIFICATE OF CORRECTION

PATENT NO. : 7,010,027

APPLICATION NO. : 09/856,738

ISSUE DATE : March 7, 2006

INVENTOR(S) : Denis Julien Gilles Mestdagh et al.

It is certified that an error appears or errors appear in the above-identified patent and that said Letters Patent is hereby corrected as shown below:

In column 2, lines 46 - 47 should read:

--high transmission rate, the system uses N=4096/p tones spaced by 4.3125q kHz wherein p and q are powers of 2 (p=1, 2, 4, 8, . . . ; q=1, 2, 4, 8, . . .).--

Column 4, line 29 should read:
--tion by the analog front-end. --

Claim 1, line 2 should read:
--QAM modulation on N=4096/p tones spaced 4.3125q kHz 2--

MAILING ADDRESS OF SENDER (Please do not use customer number below):
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JAN 1 9 2007